

THE *ENCARSIA CUBENSIS* SPECIES-GROUP
(HYMENOPTERA: APHELINIDAE)

GREGORY A. EVANS AND ANDREW POLASZEK

(GAE) Entomology and Nematology Department, University of Florida, PO Box 110620, Gainesville, FL 32611-0620, U.S.A. (e-mail: gae@gnv.ifas.ufl.edu); (AP) International Institute of Entomology, % The Natural History Museum, Cromwell Road, London SW7 5BD, U.K.

Abstract.—Taxonomic, host, and geographic range information for the six species comprising the *Encarsia cubensis* species-group is provided. Three new species, *E. aleurothrix*, *E. hansonii*, and *E. hamoni*, are described from Brazil, Costa Rica, and Florida (USA), respectively. A lectotype is designated for *E. nigricephala* Dozier.

Resumen.—Se informa sobre la taxonomía, los hospederos y la distribución geográfica de seis especies que pertenecen al grupo de la especie *Encarsia cubensis*. Se describe tres nuevas especies, *E. aleurothrix*, *E. hansonii* y *E. hamoni* recolectadas en Brasil, Costa Rica y Florida (EEUU), respectivamente. Se designa el lectotipo para *E. nigricephala* Dozier.

Key Words: *Encarsia*, whiteflies, parasitoids, biological control, taxonomy, Nearctic, Neotropical, *Bemisia*, *Aleurothrixus*.

As here defined, the *Encarsia cubensis* species-group consists of six species, all of which parasitize whiteflies in the New World, except for one species (*E. nigricephala* Dozier) which apparently was accidentally introduced beyond its natural range into Réunion (Mascarene Islands, Indian Ocean). Various economically important whitefly species are attacked by members of this group. *Encarsia nigricephala* is one of the most common parasitoids of the *Bemisia tabaci* species-complex (Aleyrodidae) throughout the New World. *Encarsia quaintancei* Howard is a major parasitoid of the banded-winged whitefly, *Trialeurodes abutiloneus* (Haldeman), and also attacks the *Bemisia tabaci* species-complex.

Gahan (1931) first recognized these species as comprising a distinct group in the genus *Encarsia* and characterized it as spe-

cies having only four tarsomeres on the middle tarsus and the presence of an area around the stigmal vein devoid of setae. DeBach and Rose (1981) erected the *Encarsia cubensis* species-group. *Encarsia cubensis* and *E. quaintancei* had previously been included in the 'formosa-group' (= *luteola*-group) by Viggiani and Mazzone (1979). Polaszek et al. (1992) provided taxonomic, host and distribution information for *E. nigricephala* and *E. quaintancei*. Schauff et al. (1996) updated host and distribution records for these two species, and provided information on *E. cubensis*.

The *Encarsia cubensis* species-group can be defined using a combination of characters, none of which alone, however, distinguishes this group from other species-groups of *Encarsia*. For example, species belonging to the *parvella*- and *citrina*-

Table 1. Characteristics of the *Encarsia cubensis* species group compared with those of similar *Encarsia* species groups.

Species Group	Tarsal Formula	Fore Wing Asetose Area	Fore Wing Disc Width	Gastral Tergite	Host	Male Antenna
<i>cubensis</i>	5-4-5	yes	normal-broad	smooth	whitefly	F2 modified
<i>luteola</i>	5-4-5	no	normal-broad	smooth	whitefly	normal
<i>singularis</i>	5-4-5	no	narrow	sculptured	diaspine scale	F1 modified
<i>citrina</i>	5-5-5	yes	narrow-normal	sculptured	diaspine scale	normal
<i>parvella</i> / <i>pergandiella</i>	5-5-5	yes	narrow-broad	smooth	whitefly	normal

groups also possess the asetose area around the stigmal vein of the fore wing. The 4-segmented mid tarsus is also found in the *luteola*- and *singularis* groups, as well in some unplaced species (e.g. *E. africana* (Hill) and *E. mohyuddini* Shafee and Rizvi). Reduction in the number of segments of the mid tarsus appears to have occurred independently in different lineages within *Encarsia*. Certainly within the Aphelinidae and the Chalcidoidea as a whole, reduction in number of tarsal segments by fusion of the two distal segments is common.

An ovoid sensory/glandular structure is present on F2 antennal segment of the males of the three species in this group whose males are known, and is present on both the F1 and F2 segment in the male of *E. hansonii*. Potentially, this structure is a unique synapomorphy for the *cubensis* species group; however, males of the *singularis*-group, a small group of armored scale parasitoids from the Oriental region, have a similar structure on the F1 antennal segment. Pedata et al. (1995) first demonstrated that these structures, often referred to as 'sensorial complexes' (Viggiani and Mazzone 1982, Polaszek et al. 1992), are at least partially glandular. Viggiani (1996) demonstrated that in *E. nigricephala* (and presumably in *E. quaintancei* and *E. hamoni*) the structure is entirely glandular. The form of these structures agrees at least partially with the 'release and spread' function attributed to similar antennal glands by Isidoro et al. (1996).

Within *Encarsia*, members of the *E. cub-*

ensis-group show greatest affinity with members of the *parvella*-group, with which they share the asetose area of the fore wing, and from within which they may be derived. Characteristics of the *E. cubensis*-group are compared with those of related *Encarsia* species groups (Table 1).

The following six species are placed in the *E. cubensis* group: *E. aleurothrixii* Evans and Polaszek, n. sp., *E. cubensis* Gahan, *E. hamoni* Evans and Polaszek, n.sp., *E. hansonii* Evans and Polaszek, n. sp., *E. nigricephala* Dozier and *E. quaintancei* Howard.

Morphological terminology follows that of Hayat (1989). The scutellar setae are designated Sc1 (anterior pair) and Sc2 (posterior pair) as used in Evans et al. (1995). The length of the fore wing disc (Fig. 18, fd) is measured from the midpoint of an imaginary line drawn between the apex of the stigmal vein and the distal end of the frenal fold of the fore wing, to the fore wing apex. The width of the fore wing (Fig. 18, fww) refers to the maximum width of the fore wing; the length of the marginal fringe, refers to the length of the longest seta of the marginal fringe. Habitus drawings for each species show the gaster divided medially, with the dorsum on the left side and the venter on the right side. The tibia and tarsus of the middle leg for the female of each species is drawn on its left side. An asterisk is placed before new host and/or distribution records.

Holotypes of all members of the *E. cubensis* species group are deposited in the Na-

tional Museum of Natural History, Smithsonian Institution (USNM) in Washington, D.C., U.S.A. Paratypes of *E. aleurothrix* are deposited in The Natural History Museum, London, U.K. (BMNH), Florida State Collection of Arthropods, Gainesville, Florida, U.S.A (FSCA) and in the G. A. Evans, personal collection (GAE). Additional specimens of *E. cubensis* and *E. nigricephala* are deposited in the Centre de Cooperation Internationale en Recherche Agronomique pour le Developpement, Montpellier, France (CIRAD).

ENCARSIA CUBENSIS SPECIES-GROUP

Diagnosis.—Tarsal formula 5-4-5; fore wing moderate to broad in width with large aetose area beneath the stigmal vein, longest seta of marginal fringe not longer than maximum width of fore wing, distance between placoid sensilla on scutellum more than 2.5× the diameter of one sensillum, base of gastral tergite I smooth.

Additional characteristics observed in species of this group include: antennal club 3-segmented, F1 antennal segment usually short, quadrate or nearly so and shorter than pedicel, ovipositor short to moderate in length, subequal to length of tibia II and not exceptionally extruded, mesoscutum with 2 to 3 pairs of setae, males with antennal segments F5 and F6 fused, F2 (rarely F1) with an ovoid sensory/glandular structure covered by a plate (Figs. 11, 15).

KEY TO *ENCARSIA CUBENSIS* SPECIES-GROUP

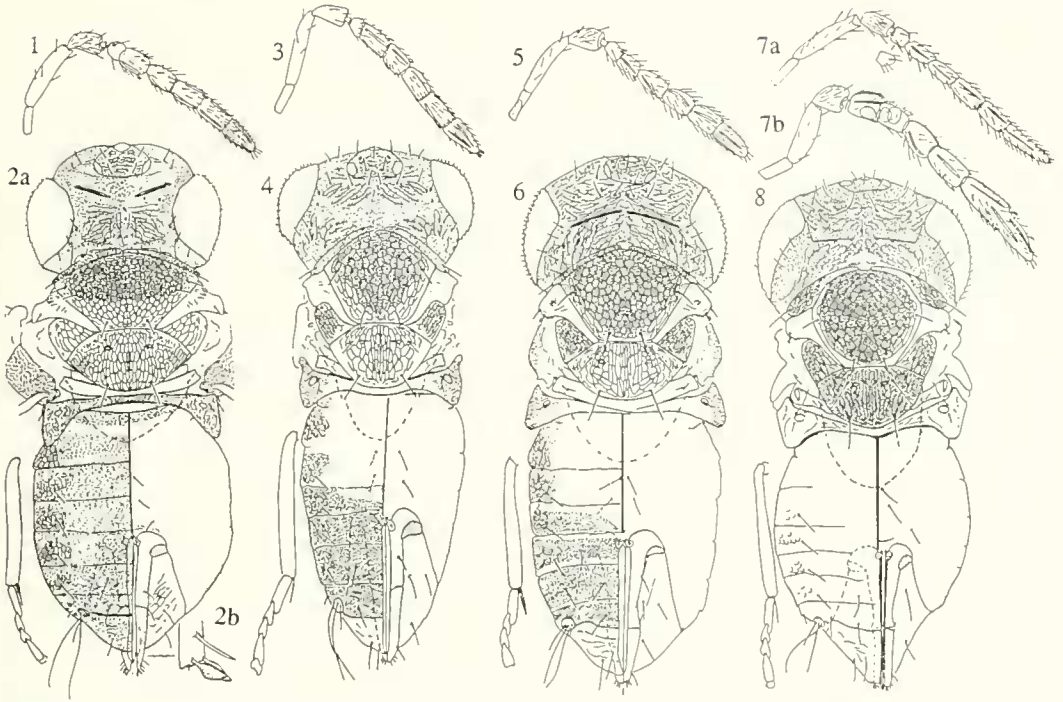
- 1. Mesoscutum with 2 pairs of setae, gaster completely yellow, or dark brown with central portion of tergites I and II yellow, (Figs. 4, 6, 8, 10) 2
- Mesoscutum with 3 pairs of setae, gaster completely dark brown, (Figs. 2, 14) 5
- 2. Gaster completely yellow, fore wing almond-shaped, pointed at apex (Figs. 19, 21); males known 3
- Gaster dark brown with central portion of tergites I and II yellow, fore wing round at apex (Figs. 18, 20); males unknown 4
- 3. Scutellum dark brown, F1 oblong and quadrate, F6 elongate, 3.2× as long as wide (Fig. 7), 2 pairs of setae between cerci of tergite VI.

- (Fig. 8). Male with ovoid glandular structure on F1 and F2, F3 slightly longer than F2 *hansonii*
- Scutellum yellow, F1 cylindrical, 1.5–1.7× as long as wide, F6 not exceptionally elongate, 2.4× as long as wide (Fig. 9), 1 pair of setae between cerci of tergite VI. (Fig. 10). Male (Fig. 12) with ovoid glandular structure on F2, F3 shorter than F2 segment (Fig. 11) *nigricephala*
- 4. Valvula III elongate (Fig. 4), 0.6× as long as ovipositor, F2 longer than F3 (Fig. 3) *cubensis*
- Valvula III 0.4× as long as ovipositor (Fig. 6), F2 shorter than F3 (Fig. 5) *hamoni*
- 5. Axillae and posterior half of mesoscutum yellow, second pair of mesoscutal setae proximal to anterior pair of setae (Fig. 2), valvula III with spatulate apical setae, F1 quadrate, 0.5× as long as F2 (Fig. 1); male unknown. *aleurothrix*
- Axillae and entire mesoscutum (except margins) dark brown, second pair of mesoscutal setae located approximately halfway between anterior and posterior pairs of setae (Fig. 14), valvula III with apical setae slender, F1 cylindrical, 0.75× as long as F2 (Fig. 13). Male with F3 longer than F2 (Fig. 16) and tibia III brownish *quaintancei*

***Encarsia aleurothrix* Evans and Polaszek, new species**
(Figs. 1, 2a, 2b, 17)

Diagnosis.—The female of *E. aleurothrix* can be distinguished from other *Encarsia cubensis* group species by the unusual spatulate setae located on the apex of valvula III (may be difficult to discern unless viewed with phase-contrast microscopy), and by the anterolateral position of the second pair of mesoscutal setae. This species is most similar to *E. quaintancei* in coloration and number of mesoscutal setae, but can be distinguished from the latter species which has the second pair of mesoscutal setae located approximately halfway between the anterior and posterior pair of setae, the F1 antennal segment more elongate, the axillae dark brown, and slender apical setae on valvula III.

Description.—Female holotype. Coloration (Fig. 2): Head dark brown, eyes red, antenna pale, anterior half of mesoscutum, metanotum and gaster, dark brown; rest of



Figs. 1-8. 1-2 *Encarsia aleurothrix* 1, Antenna, female. 2a, Habitus, female. 2b, Valvula III, apex. 3-4, *E. cubensis*. 3, Antenna, female. 4, Habitus, female. 5-6, *E. hamoni*. 5, Antenna, female. 6, Habitus, female. 7-8, *E. hansonii*. 7a, Antenna, female. 7b, Antenna, male. 8, Habitus, female.

mesosoma and legs, yellow; coxa III and valvula III infusate; wings hyaline. Morphology: Antennal (Fig. 1) radicle (R), scape (S), pedicel (P), 3 funicle segments (F1-F3) and 3 club segments (F4-F6) with the following ratios of length to width: R: 3.6, S:4.5, P:1.4, F1:1.0, F2:1.7, F3:1.7, F4: 1.5, F5:1.5 and F6:1.8; relative lengths of segments R-F6 to length of F1: R:1.8, S: 4.5, P:1.8, F1:1.0, F2:1.9, F3:2.1, F4:2.1, F5:2.1, and F6:2.4; F1-F6 with the following number of linear sensilla: F1:0, F2:2, F3:2, F4:2, F5:3, F6:3. Mesoscutum with narrow, hexagonal sculpture, and 3 pairs of slender setae arranged as in Fig. 1; each side lobe with 2 setae; each axilla with 1 short seta, scutellar seta Sc1 0.7× as long as Sc2; distance between scutellar sensilla 5× the width of one sensillum; endophragma short, reaching halfway to posterior base of gastral tergite I; tibial spur of middle leg 0.7× corresponding basitarsus. Fore

wing (Fig. 17) broad, disc 0.9× as long as wide, marginal fringe 0.3× width of wing; discal setae uniformly distributed except wide bare area along the distal margin of the fore wing and area surrounding stigmal vein; 6-7 costal, 2-3 basal group, and 2 submarginal vein setae; marginal vein with 5-6 long and stout setae along its anterior margin, 2 large setae at its base, and 7-8 short setae along its interior. Gastral tergites 1-V dorsum with reticulate lateral margins, tergites V and VI with stipules, centrally; tergites I-VII with 0, 1, 1, 1, 2, 2, 2 pairs of setae, respectively. Venter with 2 pairs of setae at sternite II, III and IV, respectively; ovipositor arising at anterior base of tergite IV, as long as tibia of middle leg; valvula III slender, 0.5× ovipositor, with 2-3 pairs of distally-expanded, apical setae.

Male.—Unknown.

Distribution.—Brazil.

Hosts.—*Aleurothrixus aepim* (Goldi), *Aleurothrixus floccosus* (Maskell).

Material examined.—Brazil, Aguas de São Paulo, 24.i.1988, ex. *Aleurothrixus aepim* on *Manihot esculentum*, F.D. Bennett, (Holotype ♀ and 2 ♀ paratypes, USNM; 5 ♀ paratypes, BMNH; 8 ♀ paratypes, FSCA; 8 ♀ paratypes, GAE); Brazil, Piracicaba, 27.v.1991, ex. *Aleurothrixus floccosus* on *Citrus* sp., F. D. Bennett, (12 ♀ paratypes, GAE).

Etymology.—The species name is derived from its host, *Aleurothrixus*.

Encarsia cubensis Gahan
(Figs. 3, 4, 18)

Encarsia cubensis Gahan 1931:121.

Trichoporus cubensis: Dozier 1933:92.

Types.—Three syntype females reared from *Aleurothrixus howardii* (= *A. floccosus*), Santiago de las Vegas, Cuba, received from S. C. Bruner, in USNM [examined].

Diagnosis.—The female of *E. cubensis* can be distinguished from other *E. cubensis* group species (except *E. hamoni*) by having 2 pairs of mesoscutal setae and dark brown gaster with central portion of tergites I and II, yellow. *E. cubensis* is most similar to *E. hamoni* in coloration and number of mesoscutal setae and can be distinguished from that species by having the F2 longer than F3 antennal segment, the F1 antennal segment very short, 0.5× as long as F2, and valvula III 0.6× as long as the ovipositor.

Description.—Female syntype. Coloration (Fig. 4): Head, pronotum, mesoscutum (except lateral margins), axillae (except small, basal triangular area), lateral margins of metanotum and gaster, tergites I and II, and tergites III–VI, dark brown; lateral margins of mesoscutum, side lobes, scutellum, central area of tergites I and II, tergite VII and legs, yellowish; F6 antennal segment infusate; wings hyaline. Morphology: Antennal segments (Fig. 3) with the following length to width ratios: R:3.0, S:5.0, P:1.8, F1:1.0, F2:1.8, F3:1.6, F4:1.8, F5:1.8, and F6:2.3; relative lengths of segments R–F6

to length of F1: R:1.7, S:4.7, P:2.0, F1:1.0, F2:2.0, F3:1.8, F4:2.0, F5:2.2 and F6:2.5; linear sensilla present on flagellar segments F2–F6. Mesoscutum with broad, hexagonal sculpture and 2 pairs of short setae; each axilla with 1 short seta, scutellar seta Sc1 0.6× as long as Sc2; distance between scutellar sensilla 5.2× width of one sensillum; endophragma short, not reaching tergite II; tibial spur of middle leg 0.8× length of corresponding basitarsus. Fore wing (Fig. 18) broad, disc 1.1× as long as wide, marginal fringe 0.4× width of fore wing; discal setae uniformly distributed except a wide asetose band along the distal margin of the fore wing and asetose area surrounding stigmal vein; 6–7 costal, 2 basal group, and 2 submarginal vein setae; marginal vein with 5–6 setae along its anterior margin, 2 setae at its base, and 7–8 short setae along its interior. Gastral tergites I–V dorsum with imbricate lateral margins, stipules present on tergites V–VI, centrally; tergites I–VII with 0, 1, 1, 1, 2, 2, 2 pairs of setae, respectively. Venter with a pair of setae at sternites I and II; ovipositor arising at level of tergite III, as long as tibia of middle leg; valvula III, 0.6× as long as ovipositor.

Male.—Unknown.

Hosts.—*Aleurothrixus floccosus* (Maskell), **Aleurotrachelus trachoides* (Back).

Distribution.—Brazil; Cuba; *Dominican Republic; *Guadeloupe; Haiti; Puerto Rico; USA: Florida.

Specimens examined.—In addition to syntypes, Dominican Republic, Charco Azul, 16.i.1995, ex. ?*Aleurothrixus* sp. on *Manihot esculentum*, C. A. Serra (1 ♀, GAE); Guadeloupe: Vernon, 21.vi.1990, ex. **Aleurotrachelus trachoides*, J. Etienne, (1 ♀, CIRAD); Dom. Dudos, 1.ii.1990, J. Etienne (1 ♀, CIRAD); Puerto Rico: Avecibo, 19.x.1990, *Aleurothrixus floccosus* on *Tabebuia glomerata*, F. D. Bennett (2 ♀, GAE); USA: Florida, Miami, 22.iii.1992, ex. whitefly on *Cocos nucifera*, F. D. Bennett (1 ♀, GAE).

***Encarsia hamoni* Evans and Polaszek,
new species**
(Figs. 5, 6, 20)

Diagnosis.—The female of *E. hamoni* can be distinguished from the other *Encarsia cubensis* group species (except *E. cubensis*) by its dark brown gaster with yellow central area of tergites I and II, 2 pairs of mesoscutal setae, and rounded apex of the fore wing. *E. hamoni* is most similar to *E. cubensis* and can be distinguished from the latter species by having valvula III shorter, 0.4× as long as the ovipositor; F2 shorter than F3; and axillae completely dark brown.

Description.—Female holotype. Coloration (Fig. 6): Head, pronotum, mesoscutum (except lateral margins), axillae, lateral margins of metanotum and gastral tergites I and II, and tergites III–VI, dark brown; lateral margins of mesoscutum, side lobes, scutellum, central area of tergites I and II, tergite VII and legs, yellow; wings hyaline. Morphology: Antennal segments (Fig. 5) with the following ratios of length to width: R:1.9, S:4.5, P:1.9, F1:1.0, F2:1.6, F3:1.9, F4:1.5, F5:1.5 and F6:1.8; relative lengths of segments R–F6 to length of F1: R:1.9, S:4.5, P:1.9, F1:1.0, F2:1.6, F3:1.9, F4:1.9, F5:2.0, and F6:2.4; F1–F6 with the following number of linear sensilla: F1:0, F2:2, F3:2, F4:2, F5:3, F6:3. Mesoscutum with broad, hexagonal sculpture and 2 pairs of slender setae; each side lobe with 2 setae; each axilla with 1 seta, scutellar setae Sc1 0.7× as long as Sc2; distance between scutellar sensilla 5× the width of one sensillum; endophragma short, reaching almost to posterior base of gastral tergite I; tibial spur of middle leg 0.7× corresponding basitarsus. Fore wing (Fig. 20) broad, disc 0.9× as long as wide, marginal fringe 0.3× width of wing; discal setae uniformly distributed except wide bare area along the distal margin of the fore wing and the area surrounding stigmal vein; 6–7 costal, 1 basal group, and 2 submarginal vein setae; marginal vein with 5–6 long and stout setae along its anterior margin, 2 large setae at its base, and

7–8 short setae along its interior. Gastral tergites I–V dorsum with reticulate lateral margins, tergites V and VI with stipules, centrally; tergites I–VII with 0, 1, 1, 1, 2, 2, 2 pairs of setae, respectively. Venter with 2 pairs of setae at sternite II, III and IV, respectively; ovipositor arising at anterior margin of tergite IV, as long as tibia of middle leg; valvula III slender, 0.4× ovipositor.

Male.—Unknown.

Distribution.—U.S.A.: Florida, Georgia; Mexico.

Hosts.—*Tetraleurodes ursorum* (Cockerell); *Bemisia tabaci* species-complex.

Material examined.—U.S.A: Florida, Davie, 24.ii.1994, ex. *Tetraleurodes ursorum* on *Annona glabra*, A. B. Hamon, (Holotype ♀ and 3 ♀ paratypes, USNM; 2 ♀ paratypes, BMNH; 1 ♀ paratype, GAE). Additional specimens: USA: Georgia, Tifton, x.1992, *Bemisia tabaci* species-complex on *Gossypium hirsutum*, J. Chamberlain, (1 ♀, GAE); Mexico: Sinaloa, Guasave, 12.x.1990, B. Alvarado, (2 ♀, GAE).

Etymology.—This species is named in honor of Avas Hamon for his many years of assistance in the identification of whitefly and scale insect hosts.

***Encarsia hansoui* Evans and Polaszek,
new species**
(Figs. 7a, 7b, 8, 19)

Diagnosis.—The female of *E. hansoui* can be distinguished from the other *E. cubensis* group species by having the scutellum completely dark brown; the F1 antennal segment short and oblong; and the F6 antennal segment very elongate, 3.4× as long as wide.

Description.—Female holotype. Coloration (Fig. 8): Head dark brown, eyes red, antennae pale; mesoscutum (except for lateral margins), axillae and scutellum, dark brown; metanotum, gaster, and legs, yellowish; wings hyaline. Morphology: Antennal segments (Fig. 7a) with the following ratios of length to width: R:4.0, S:5.0, P:1.3, F1:0.8 (ventral margin) and 1.0 (dorsal margin), F2:1.8, F3:1.9, F4:1.8, F5:2.0 and

F6:3.4; relative lengths of segments R–F6 to length of F1 (ventral margin): R:2.0, S:5.6, P:2.6, F1:1.0, F2:2.0, F3:2.1, F4:2.3, F5:2.5, and F6:3.9; F1–F6 with the following number of linear sensilla: F1:0, F2:1, F3:2, F4:3, F5:3, F6:3. Mesoscutum with broad, hexagonal sculpture and 2 pairs of slender setae; each side lobe with 2 setae; each axilla with 1 seta, scutellar setae Sc1 0.9× as long as Sc2; distance between scutellar sensilla 5× the width of one sensillum; endophragma short, reaching anterior base of tergite II; tibial spur of middle leg 0.9× as long as corresponding basitarsus. Fore wing (Fig. 19) almond-shaped, disc 1.4× as long as wide, marginal fringe 0.5× width of wing; discal setae uniformly distributed except for wide asetose band along the distal margin and large, asetose area surrounding stigmal vein; 5 costal, 2 basal group, and 2 submarginal vein setae; marginal vein with 5 setae along its anterior margin, 2 large setae at its base, and 7–8 short setae along its interior. Gastral tergites II–V dorsum with imbricate lateral margins, tergite VI smooth, tergite VII rugose; tergites I–VII with 0, 1, 1, 1, 2, 3, 2 pairs of setae, respectively. Venter with a pair of setae at sternite I, II and III, respectively; ovipositor arising at level of tergite III, 1.1× as long as tibia of middle leg; valvula III slender, 0.4× length of ovipositor.

Male.—(Specimen collected in a pan trap near the location of the holotype female and assumed to be the male of *E. hansonii*.) Coloration: Body dark brown, lateral margins of mesoscutum, side lobes, base of axillae, and scutellum, yellow; gaster tergite VII light brown; legs and antenna, pale; wings hyaline. Antennal segments (Fig. 7b) with the following length to width ratios: R:2.5, S:3.7, P:1.1, F1:1.0, F2:1.1, F3:1.2, F4:1.6, F5 + F6 (fused):3.6; ratio of each segment to length of F1: R:1.0, S:2.1, P:1.0, F1:1.0, F2:0.9, F3:1.1, F4:1.4, F5 + F6 (fused):3.4; F2 with 2 ovoid sensory/glandular structures covered by plate having 2 holes; F1 with 1 ovoid sensory/glandular structure; proximal half of F3 surface with rugose

area; mesosomal sculpturing and setation and fore wing similar to those of female.

Distribution.—Costa Rica.

Host.—Unknown.

Material examined.—Costa Rica, La Selva, 17.vii.1995, C. Godoy and P. Hanson, (Holotype ♀, USNM); Costa Rica, 3 km south of Puerto Viejo, La Selva, i.1993, pan trap, P. Hanson, 1 ♂, USNM).

Etymology.—This species is named in honor of Paul Hanson, University of Costa Rica.

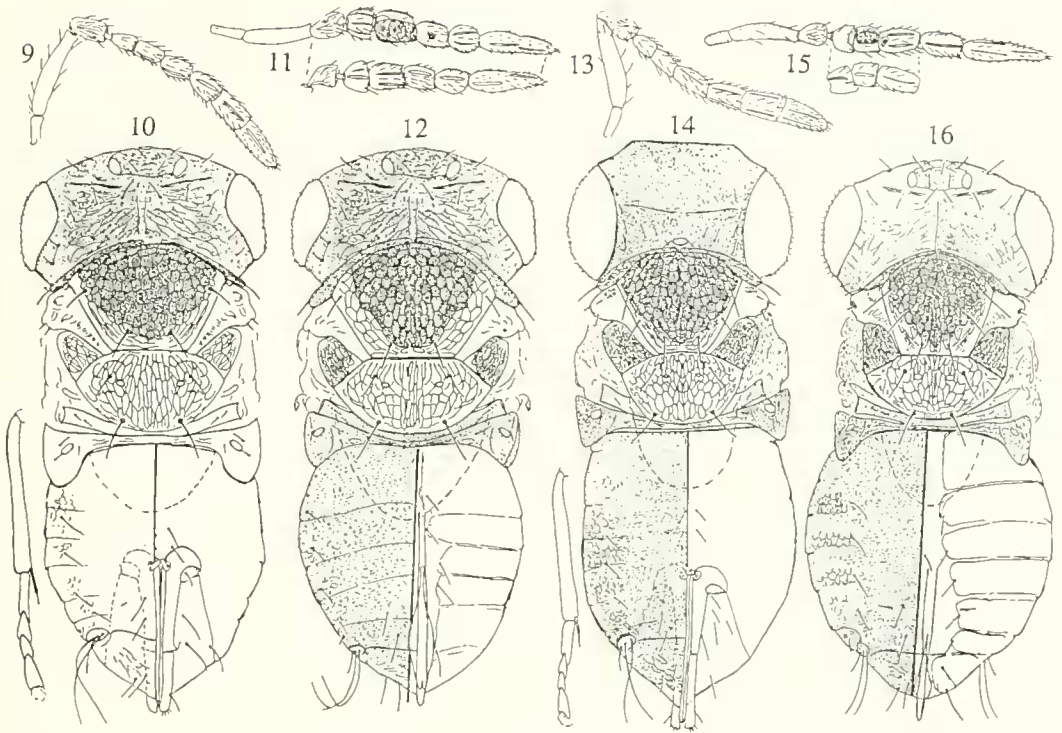
Encarsia nigricephala Dozier
(Figs. 9, 10, 11, 12, 21)

Encarsia nigricephala Dozier, 1937: 129.

Type.—Lectotype female and two paralectotype females (here designated) reared from *Bemisia* sp. on *Euphorbia hypericifolia*, Feb. 26, 1936, Mayaguez, Puerto Rico, in USNM. [examined]

Diagnosis.—The female of *E. nigricephala* can be distinguished from other *E. cubensis* group species by its dark brown head and anterior third to two thirds of mesoscutum, contrasting with the pale color of the remainder of the body. Males of *E. nigricephala* can be distinguished from *E. quaintancei* males by having 2 pairs of setae on the mesoscutum, the F2 longer than F3 antennal segment, and the hind tibia yellow. Males of *E. nigricephala* lack the ovoid sensory/glandular structure on the F1 antennal segment which is present in males of *E. hansonii*.

Description.—Female holotype. *Coloration*: (Fig. 10) Body yellowish with head, pronotum, and anterior third to two thirds of mesoscutum, dark brown; antenna and legs pale, F6 slightly infuscate; wings hyaline. *Morphology*: Antennal segments (Fig 9) with the following ratios of length to width: R:3.4, S:5.6, P:1.5, F1:2.0, F2:2.4, F3:2.0, F4:1.8, F5:1.7 and F6:2.3; relative lengths of segments R–F6 to length of F1: R:1.1, S:2.8, P:1.1, F1:1.0, F2:1.2, F3:1.1, F4:1.1, F5:1.2, and F6:1.5; linear sensilla present on F2–F6. Mesoscutum with me-



Figs. 9-16. 9-12, *Encarsia nigricephala*. 9, Antenna, female. 10, Habitus, female. 11, Antenna, male (dorsal/ventral). 12, Habitus, male. 13-16, *E. quintancei*. 13, Antenna, female. 14, Habitus, female. 15, Antenna, male. 16, Habitus, male.

dium to broad hexagonal sculpture and 2 pairs of slender setae; each side lobe with 2 setae; each axilla with 1 seta, scutellar with Sc1 $0.6\times$ as long as Sc2; distance between scutellar sensilla about $6\times$ the width of one sensillum; endophragma short, reaching base of tergite II; tibial spur of middle leg $0.6-0.8\times$ as long as corresponding basitarsus. Fore wing (Fig. 21) almond-shaped, disc $1.3\times$ as long as wide, marginal fringe $0.5\times$ width of wing; discal setae uniformly distributed except wide asetose band along the distal margin and large, asetose area surrounding stigmal vein; 4-5 costal, 1 basal group, and 2 submarginal vein setae; marginal vein with 5-6 setae along its anterior margin, 2 setae at its base, and 6-7 short setae along its interior. Gastral tergites I-VI dorsum with imbricate lateral margins, tergite VII rugose; tergites I-VII with 0, 1, 1, 1, 2, 2, 2 pairs of setae,

respectively. Venter with a pair of setae at sternite II and III, respectively; ovipositor arising at level of tergite III, $0.9\times$ as long as tibia of middle leg; valvula III slender, $0.4-0.5\times$ length of ovipositor.

Male.—(Description based upon specimen reared from the *Bemisia tabaci* species-complex, Puerto Rico, Mayaguez, 31.v.90, on *Lantana camara*, F.D. Bennett.) Coloration: Body dark brown, lateral margins of mesoscutum, side lobes, base of axillae, and scutellum, yellowish; legs and antenna, pale; wings hyaline. Antennal segments (Fig. 11) with the following length to width ratios: R: 3.0, S:4.1, P:1.3, F1:0.9, F2:1.6, F3:1.2, F4:1.3, F5 + F6 (fused):3.1; ratio of each segment to length of F1: R: 1.4, S:2.8, P:1.2, F1:1.0, F2:1.8, F3:1.2, F4: 1.3, F5 + F6 (fused):3.2; F2 longer than F3 and with 2 large, ovoid sensory/glandular structures covered by plate having 2 holes.

Ventral margins of funicle segments F2 and F3 longer than dorsal margins; mesosomal sculpturing and setation and fore wing similar to those of female.

Morphological variation.—We have examined hundreds of specimens of this species from a wide variety of hosts throughout the New World and have found very little morphological variation. The size of the dark brown area on the mesoscutum varies occasionally. Normally, this area covers approximately the anterior half of the mesoscutum; however, several specimens reared from *Bemisia argentifolia* in Guadeloupe and Colombia have the mesoscutum nearly entirely dark brown. The posterior margin of the scutellum is dark brown in a few specimens reared from *B. tabaci* species-complex in Georgia.

One male specimen, reared from an aleyrodid species on *Sonchus* sp. in Piracicaba, Brazil by F.D. Bennett, differs from *E. nigricephala* by having the F2 wider than long, subequal in length to the F3 antennal segment, and the last segment of the mid tarsus, dark brown. This specimen may represent a variation of *E. nigricephala* or possibly a distinct species.

Hosts.—**Aleurodicus dispersus* Russell, **Aleurotrachelus atratus* Hempel, *Bemisia argentifolia* Perring and Bellows, *B. tabaci* (Genn.), **Crenidorsum* sp., **Dialeurodes kirkaldyi* (Kotinsky), **Tetraleurodes acaciae* (Quaintance), *Trialeurodes abutiloneus* (Haldeman), *T. floridensis* (Quaintance), *T. vaporariorum* (Westwood).

Distribution.—Barbados; Brazil; Colombia; *Ecuador; Grenada; Guadeloupe; *Guatemala; Honduras; Jamaica; Mexico; Puerto Rico; USA: Florida, Georgia, *Maryland, *Mississippi, Texas; Venezuela.

Specimens examined representing new host or distribution records.—Ecuador: Queredo, *Bemisia tabaci* species-complex on *Chamaesyce hirta*, 14.vi.1994, P. Stansly; Guatemala: (sent to Gainesville, Florida quarantine), 21.x.1991, ex. *Bemisia tabaci* species-complex; U.S.A., Florida, Indian River Beach, 10.iv.1987, ex. *Crenidorsum*

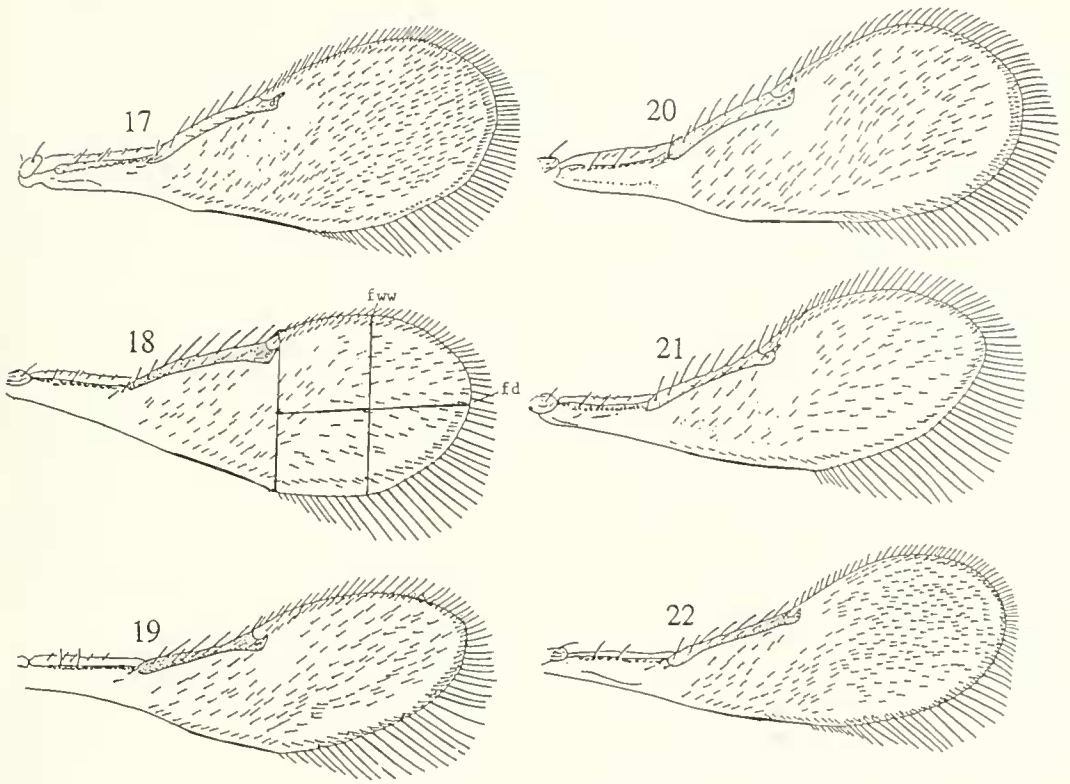
sp., on *Coccoloba uvifera*, D. Mooney; U.S.A., Maryland, Colesville, 8.xi.1993, ex. *Bemisia argentifolia* on *Lycopersicon esculentum*, G. A. Evans; U.S.A., Mississippi, 1996, *Bemisia tabaci* species-complex on *Gossypium hirsutum*, M. Smith; U.S.A., Florida, Homestead, 5.ii.1991, *Aleurodicus dispersus* on ornamental tree, F. D. Bennett; U.S.A., Miami, 22.iii.1990, *Aleurotrachelus atratus* on *Cocos nucifera*, F. D. Bennett; U.S.A., Florida, Homestead, *Dialeurodes kirkaldyi* on ornamental tree, F. D. Bennett; Puerto Rico: Rio Piedras, 18.xi.1989, *Tetraleurodes acaciae* on *Jatropha gossypifolia*, F. D. Bennett. All of the above specimens deposited in GAE collection. Reunion: 1 ♀, Piton Saint Leu, 21.v.1990, ex. *Trialeurodes vaporariorum*, B. Reynaud (CIRAD).

Encarsia quaintancei Howard
(Figs. 13, 14, 15, 16, 22)

- Encarsia quaintancei* Howard 1907: 79.
Prospaltella perspicuipennis Girault 1910: 234.
Encarsia perspicuipennis: Viggiani 1986: 71, n. comb., lectotype designated.
Prospaltella perspicuipennis: Polaszek et al. 1992: 387, synonymy.

Type.—Holotype female reared from *Aleyrodes* sp. on *Polygonum* sp., Washington, D.C., Bladensburg Road, 29.viii.1900, Theo. Pergande, in USNM [examined]. We consider the identification of the whitefly host of the holotype specimen as *Aleyrodes* sp. to be erroneous and probably represents either *Trialeurodes abutilonea* or *T. vaporariorum* listed by Mound and Halsey (1978) as the whitefly species found on this host plant in the United States.

Diagnosis.—The female of *E. quaintancei* can be distinguished from other *E. cubensis* group species by having the scutellum bright yellow, contrasting with its dark brown head, mesoscutum and gaster, the F1 antennal segment cylindrical, and three pairs of mesoscutal setae. Males of this species can be distinguished from *E. nigrice-*



Figs. 17-22. Fore wings of *Encarsia* females. 17, *E. aleurothrix*. 18, *E. cubensis*. 19, *E. hansonii*. 20, *E. hanoni*. 21, *E. nigricephala*. 22, *E. quintancei*.

phala and *E. hansonii* males by having three pairs of mesoscutal setae, the F2 shorter than the F3 antennal segment, and the hind tibia brownish.

Description.—Holotype female. Coloration (Fig. 14): head, pronotum, axillae, metanotum and gaster, dark brown, scutellum bright lemon yellow, legs and antenna yellowish, F6 slightly infuscate; wings hyaline. Morphology: Antennal segments with the following ratios of length to width: R: 3.0, S:6.0, P:1.9, F1:1.3, F2:1.6, F3:2.2, F4: 1.9, F5:1.7 and F6:2.4; relative lengths of segments R-F6 to length of F1: R:1.5, S: 4.2, P:1.7, F1:1.0, F2:1.3, F3:1.8, F4:1.7, F5:1.7, and F6:2.3; F1-F6; linear sensilla present on F3-F6. Mesoscutum with narrow to medium hexagonal sculpture and 3 pairs of slender setae; each side lobe with 3 setae; each axilla with 1 short seta, scu-

tellar setae Sc1 0.7 \times as long as Sc2; distance between scutellar sensilla 3 \times the width of one sensillum; endophragma short, not reaching posterior margin of tergite I; tibial spur of middle leg 0.75 \times as long as corresponding basitarsus. Fore wing (Fig. 22) apex rounded, disc 1.3 \times as long as wide, marginal fringe 0.34 \times width of wing; discal setae uniformly distributed except wide asetose band along the distal margin and large and large asetose area surrounding stigmal vein; 5-6 costal, 2-3 basal group, and 2 submarginal vein setae; marginal vein with 5 setae along its anterior margin, 2 setae at its base, and 6-7 short setae along its interior. Gastral tergites I-VI dorsum with imbricate lateral margins, tergite VII rugose; tergites I-VII with 0, 1, 1, 1, 2, 2, 2 pairs of setae, respectively. Venter with a pair of setae at sternite II and III,

respectively; ovipositor arising at level of tergite IV, as long as tibia of mid leg; valvula III slender, $0.5\times$ length of ovipositor.

Male.—(Description based upon specimen reared from *Bemisia tabaci* species-complex on *Emilia fosbergi*, USA, Florida, Ft. Pierce, 28.x.1990, F. D. Bennett). Coloration: Body (Fig. 16) dark brown, lateral and posterior margins of mesoscutum, side lobes, and scutellum, yellowish; antenna and legs pale, coxa III and femur III, brownish; wings hyaline. Antennal segments (Fig. 15) with the following length to width ratios: R:2.5, S:3.8, P:1.1, F1:0.9, F2:1.0, F3:1.8, F4:1.8, F5 + F6 (fused):3.7; ratio of each segment to length of F1: R: 1.2, S:3.2, P:1.4, F1:1.0, F2:1.2, F3:1.9, F4: 1.9, F5 + F6 (fused):3.8. F2 shorter than F3 and with 2 large, ovoid sensory/glandular structures covered by plate having 2 holes, F3 surface with striate, trapezoidal area; mesosomal sculpturing and setation and fore wing similar to those of female.

Hosts.—*Aleurothrixus floccosus*; *Bemisia argentifolia*; *B. tabaci*; *Trialeurodes abutiloneus*; *T. packardi* (Morill); **T. vaporariorum*; *Trialeurodes* sp.

Distribution.—*Brazil; El Salvador; Guadeloupe; Jamaica; Mexico; Puerto Rico; USA: District of Columbia, Florida, Illinois, Louisiana, Maryland, Mississippi; Venezuela.

Specimens examined representing new host or distribution records.—Brazil, Brasilia, iv.1992, *Trialeurodes vaporariorum*, R. Oliveira (1 ♀, 2 ♂, GAE).

Biology.—Dysart (1966) reported that this species completed its life cycle on *Trialeurodes abutiloneus* in 10 to 25 days, overwintered in the whitefly pupae and darkened the puparia of its whitefly host. However, Dysart's figure of the male antenna shows the F5 and F6 separated and the F2 segment without the ovoid sensory/glandular structure; this specimen was not *E. quaintancei* and probably represents the male of a species belonging to the *Encarsia luteola* species group.

WHITEFLY-PARASITOID HOST LIST

- Aleurodicus dispersus* Russell.—*E. nigricephala*.
Aleurothrixus aepim (Goldi).—*E. aleurothrix*.
Aleurothrixus floccosus (Maskell), woolly whitefly.—*E. aleurothrix*, *E. cubensis*, *E. quaintancei*.
Aleurotrachelus atratus Hempel.—*E. nigricephala*.
Aleurotrachelus trachoides (Back).—*E. cubensis*.
Bemisia argentifolia Perring and Bellows, silverleaf whitefly.—*E. nigricephala*, *E. quaintancei*.
Bemisia tabaci (Gennadius), sweetpotato whitefly.—*E. nigricephala*, *E. quaintancei*.
Bemisia tabaci species-complex.—*E. hamoni*.
Crenidorsum sp.—*E. nigricephala*.
Dialeurodes kirkaldyi (Kotinsky), Kirkaldy whitefly.—*E. nigricephala*, *E. quaintancei*.
Tetraleurodes acaciae (Quaintance).—*E. nigricephala*.
Tetraleurodes ursorum (Cockerell).—*E. hamoni*.
Trialeurodes abutiloneus (Haldeman), bandedwinged whitefly.—*E. nigricephala*, *E. quaintancei*.
Trialeurodes floridensis (Quaintance), avocado whitefly.—*E. nigricephala*.
Trialeurodes packardi (Morill), strawberry whitefly.—*E. quaintancei*.
Trialeurodes vaporariorum (Westwood), greenhouse whitefly.—*E. nigricephala*, *E. quaintancei*.

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